Enhanced-Strength, Thermally-stable, Edge-Bonded, Composite Joints, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

This project proposes to develop/demonstrate higher strength, low print-through, low mass, discrete core joint design and analysis method for large, lightweight, thermally-stable, composite sub-mm reflectors. Two SMLS reflector demonstrators delivered by Vanguard to JPL were optimized for thermal stability and specific stiffness. The full aperture was divided into three zones where core slots are aligned approximately perpendicular to the reflector skin. This approach was defined and selected based on: 1) a baseline core module; 2) CTE test data indicates the core laminate is anisotropic; and 3) the desire to reduce temperature induced astigmatism by use of alternating core slots. Discrete ribs were bonded up to +/-30° from the front facesheet. The project will evaluate and mature the SMLS design for NASA and JPL. Design modifications will be identified and demonstrated to preserve/improve the previously demonstrated thermal stability and stiffness. Lightweight, thermally stable, low-cost laminate designs, adhesive materials, and manufacturing methods are required to adequately strengthen rib-to-facesheet butt joints and redistribute local rib-to-facesheet loads. To minimize impact to existing SMLS' demonstration reflector mass and thermal stability, development of a novel, supplementary modular rib/clip and joining method is envisioned. The proposed approach will require finite element analyses, design activities, coupon tests, and model-to-test data correlation. Analyses will include modal, acoustic response, and strength evaluation. Potential mass reduction opportunities will be identified. Existing coupon failure modes will be evaluated and lessons learned applied to enhanced strength joint concepts. Previous demonstration reflector thermal distortion test results and correlation activities will be reviewed to reduce model uncertainty and evaluate the influence of the several types of rib/clip joints on figure change due to temperature soak.

Enhanced-strength, Thermally-stable, Edge-bonded, Composite Joints Project Image

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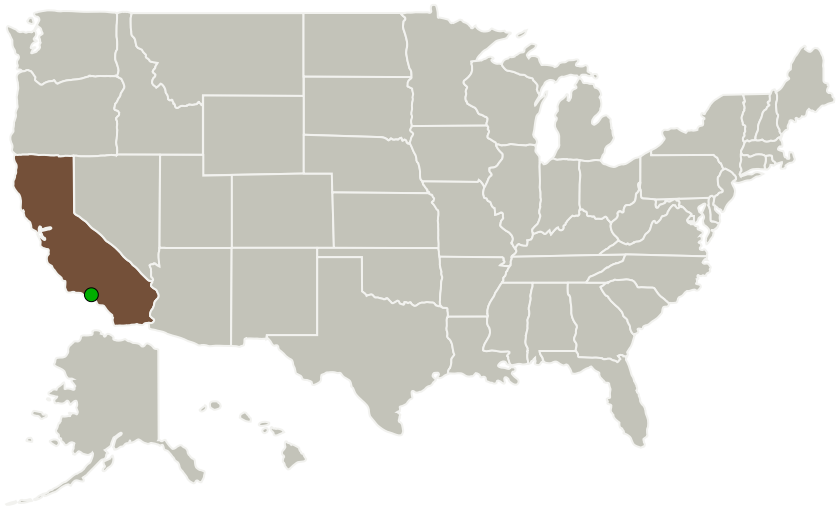
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Vanguard Space Technologies, Inc	Lead Organization	Industry	San Diego, California
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137781)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Vanguard Space Technologies, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

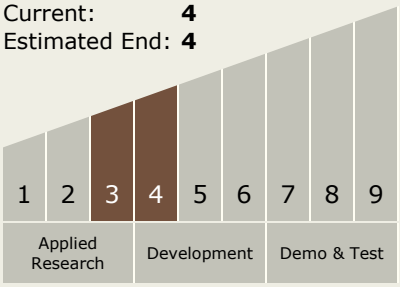
Carlos Torrez

Principal Investigator:

Jeffrey Loomis

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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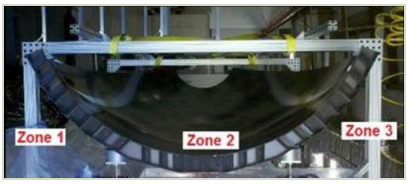
Images



Project Image
Enhanced-strength, Thermally-stable, Edge-bonded, Composite Joints Project Image
(https://techport.nasa.gov/image/135202)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.2 Structures and Antennas

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System